
Section 3: Laboratory Checklists

How To Use the Checklists:

The following checklists are provided in Section 3 in order to help identify pollution prevention opportunities in the following areas:

Table of Contents

Chemistry & Hematology	Page 3.2
Pathology/Histology	Page 3.5
Microbiology	Page 3.7
Immunology	Page 3.8
Gross Pathology and Necropsy	Page 3.9
Facility Plumbing & Cleaning	Page 3.10
Electron Microscopy	Page 3.11

Each checklist contains three columns. The first column contains a question regarding an opportunity for pollution prevention or an area of environmental concern. The second column briefly addresses the pollution prevention opportunities that can be considered. The third column refers the reader by page number to the Reference Manual where detailed information is contained on pollution prevention about the topic being addressed.

☐ Chemistry & Hematology

Have you evaluated alternate methods to perform tests?	Most lab testing is now done on automated systems that produce small volumes of wastes. Carefully select the test method that produces the best results and generates the least amount of waste. Several methods are usually available for the same parameter (Reinhardt, 1996, p.173).	Refer to Appendix C.5 Table 8 for list of equipment vendors.
Does hematology use manual iron-cyanide testing or cell lysing solution testing that generates cyanides?	Cyanide solutions exceeding 0.45 mg/l of total cyanide should not be disposed of down the drain. Store cyanide waste in secondary containment and separate from all acidic solutions. Sodium lauryl sulfate is an alternative to cyanide for automated analysis for hemoglobin.	
Have you considered ways to reduce your use of formaldehyde?	Bouin's solution used as a preservative contains concentrated formaldehyde solution. Reducing preservative volumes requires careful consideration. You may be able to reduce the volume of Bouin's used by reducing the size of your specimen containers.	p. 4.8
Do you collect your waste solvents from GC analysis and TLC analysis?	Solvents are used to extract urine and blood samples for GC analysis as well as for TLC analysis. Reduce the use of solvent by minimizing extraction sample size. Investigate using other methods and less hazardous solvents. Try and save all solvents for recycling or disposal.	p. 4.51 and 4.65.
Do you use heavy metal standards to calibrate your atomic absorption (AA) equipment?	Adhere to the City Sewer Use Ordinance limits (Appendix F) to see if the concentration of metals in these standards can be sewered, otherwise use a hazardous waste disposal firm. Prepare standards as needed to avoid excess quantities going to waste.	See p. 4.23 for more on metals
Do you use xylene for extractions or cleaning slides?	Xylene is highly flammable and toxic and should not be disposed to the sewer. Consider substituting less toxic chemicals for xylene where ever possible. Used xylene can be recycled either at your lab or sent for off-site recycling or disposal.	p. 4.13

Do you use mercury containing reagents?	Mercury may be present in reagents used for the detection of chloride with the mercuric nitrate method. Use of an alternate method such as ion-selective electrode (ISE) is preferable. Mercury containing reagents or wastes should not be sewered.	p. 4.31
Do you use chromium containing reagents?	Highly concentrated chromium may be present in reagents used for albumin testing. Refer to your MSDS sheets and if chromium is present consider using albumin testing with less toxic reagents.	p. 4.28
Do you use silver containing reagents?	Silver is present in some chemical reagents for the analysis of chlorides. Reagents with more than 5 mg/l of silver should not be sewered. Investigate alternative methods or collect your silver reagent for disposal.	p. 4.26
Do you use copper containing reagents or preservatives?	High concentrations of copper may be present in some reagents used for colorimetric analysis of total protein or in some stool preservatives. Switch to nonmetal reagents if possible.	4.23
Do you use zinc in your testing for glucose?	Zinc is found in some colorimetric glucose tests. Consider using other tests for glucose that provide equivalent or better results without producing wastes containing zinc.	4.23
Have you minimized your generation of low level radioactive wastes?	Radioimmunoassays (RIA) tests generate low level radioactive wastes. Careful selection of radionuclides, liquid scintillation cocktail, observation of holding times and proper storage will minimize your radioactive wastes disposal.	
Do you use solvent based scintillation fluids?	Xylene or toluene based scintillation fluids can be replaced in many cases by safer alternatives that are less ignitable and easier to dispose of.	Appendix C.6, Table 10
Have you examined waste streams to ensure they are not mixed wastes?	Mixed wastes may be regulated by more than one regulation (i.e. radioactive and hazardous). Segregate wastes types to avoid creating mixed wastes.	
Have you considered elimination of some RIA tests?	Some laboratories may want to reduce or eliminate the handling of low level radioactive wastes from RIA tests. Several new alternatives that produce nonradioactive wastes have been developed for the detection of microbial growth and various hormones.	Appendix C.6, Table 10

❑ Pathology/Histology		Reference Manual
Have you explored ways to reduce the amount of formaldehyde you use?	Reductions in the amount of formaldehyde used in specimen containers is possible but should be carefully evaluated prior to making any changes.	See p. 4.8 and Case Study #2 in Appendix G
Have you explored the substitutes to formaldehyde?	Formaldehyde free substitutes are commercially available and have been successfully applied.	p. 4.7
Have you considered the benefits of recycling formaldehyde, alcohols and solvents on-site?	Recycling and reuse can reduce both costs and pollution. Commercially available distillation units are available for recycling formaldehyde, alcohols and solvents on-site.	p. 4.9 and p. 4.51
Have you considered treating your waste formaldehyde to detoxify it prior to sewerage?	There are treatment products available that can be used to detoxify formaldehyde prior to disposal.	p. 4.11
Do you sewer your xylene containing solutions?	Xylene is a toxic chemical that is toxic, not miscible with water, and flammable and should not be sewered. Consider recycling, fuel supplement burning or disposal.	p. 4.13
Have you considered trying other clearants besides xylene?	There are xylene substitutes commercially available that provide an alternative.	p. 4.15
Do you distill your xylene or xylene substitutes for reuse?	Distillation of xylene and other clearants is good pollution prevention practice and can reduce your material purchasing expenses.	p. 4.17 and p. 4.51
Have you optimized your recovery of xylene and xylene substitutes?	Consult with your distillation unit supplier. Other factors that may increase your recovery are the xylene solvent grade used.	See p. 4.51 and Appendix page G.4 for a Case Study
Do you use fixatives that have mercury in them?	Common fixatives such as B-5, Helly's, and Zenkers contain mercury. Mercury bearing waste should not be sewered. There are non-mercury fixatives available.	p. 4.33

Some mordants and hematoxylin contain mercury. Have you considered the alternative products and practices?	Sodium iodate has successfully been replaced for mercury oxide in hematoxylin stain.	p. 4.34
Do you know the hazards of working with picric acid?	Some stains and fixatives may contain picric acid. It is highly reactive and may explode when dry or complexed with metals. There are safer substitutes in counterstain and fixative applications.	p. 4.8 and p. 4.47
Are you disposing of high energy waste solvents in a manner with the highest benefit to the environment?	Check to see that your waste hauler is sending allowable solvents with high energy content to a fuel blending facility instead of an incinerator if possible.	p. 4.65
Do you know if your dyes, stains and chromogens are properly disposed of?	There are hundreds of these chemicals and some are carcinogenic. Some of these can be detoxified prior to drain disposal. Others should be disposed of by a licensed waste hauler.	p. 4.45
Do you use silver stains?	Silver is a metal that should not be discharged into the sewer above 5 mg/L. Uranyl nitrate is used in small quantities as a "sensitizer" in silver stains. It is radioactive and produces a difficult waste to manage. Zinc formalin may be a satisfactory substitute.	p. 4.26
Do you hold your activated gluteraldehyde solutions prior to draining?	Large quantities of gluteraldehyde held for 14 to 21 days will lose toxicity and can then be discharged to the sewer system as long as other contaminants aren't present. You may want to reevaluate your use of gluteraldehyde.	Appendix G.5, Case Study #4

<input type="checkbox"/> Microbiology		Reference Manual
When purchasing new equipment for testing do you take into consideration the wastes produced?	New equipment is available that uses increasingly miniaturized sample volumes and produces less waste.	Appendix C.7, Table 11
Do you provide secondary containment and know the spill procedures for your staining supplies?	All staining supplies should be stored with secondary containment to prevent spills.	p. 4.45
Have you reviewed the MSDS sheets and understand the proper disposal of chemical stains?	Some stains contain hazardous materials that should not be sewered but contained and disposed of as hazardous wastes.	p. 4.45
Have you tried staining slides with a few drops instead of a dipping bath?	Wastes from excess staining chemicals and rinsing can be reduced by using a few drops to stain instead of a dipping bath.	
Does your PVA/trichrome stain use mercuric chloride?	Investigate alternative chemicals less toxic than mercury. Cupric sulfate has been used as a substitute.	p. 4.31
Do you use rapid screening tests?	Rapid screening tests can be used to eliminate a specimen from further testing. Rapid screening often improves efficiency, is cost effective, and generates less waste.	

☐ Immunology		
Do you perform various manual and semi-manual tests?	There is diagnostic equipment available that will perform various tests simultaneously with the benefits of waste minimization and improved efficiency.	Appendix C.6, Table 9
Do your buffer solutions contain thimerisol?	Thimerisol contains mercury. Evaluate the non-mercury alternatives available for your application.	p. 4.31
Do your slide preparation solutions contain metals?	Some slide preparation solutions contain copper sulfate. Avoid sewerage metal containing solutions by containing them for hazardous waste disposal. Investigate if non-metal alternatives are available for your application.	p. 4.23

❑ Gross Pathology and Necropsy		Reference Manual
Do you store your specimen in solution with formaldehyde away from sinks and drains?	Store specimen containers with formaldehyde away from sinks and floor drains to avoid spills into the sewer.	
Do you sewer waste solutions containing metals?	Waste solutions such as Zenker's and from silver staining may contain high concentrations of metals that shouldn't be sewered. Collect these for disposal as hazardous waste. Investigate substituting or eliminating metal containing solutions.	p. 4.23
Have you considered ways to reduce the amount of formaldehyde, gluteraldehyde and alcohols used?	Smaller specimen containers can reduce the volume of preservatives used. Large quantities of activated gluteraldehyde can be held for 14 to 21 days to lose toxicity before sewerage. Investigate reusing solutions on-site whenever possible.	Appendix G.5, Case Study #2 and Case Study #4
Have you investigated the use of non-metallic fixatives?	Switching to fixatives with no mercury or toxic metals can reduce your generation of hazardous wastes.	p. 4.33
Do you cold sterilize equipment?	Cold sterilization may generate spent formaldehyde, gluteraldehyde or other chemicals. Consider other methods such as autoclaving, ethylene oxide, or "Renalin" type disinfectants.	
Are your autoclaves fitted to recirculate cooling water or minimize it?	Steam sterilization with autoclaves may be one of the largest water users. Water saving modifications may pay for themselves in water bills.	

<input type="checkbox"/> Facility Plumbing & Cleaning		Reference Manual
Do you routinely maintain your neutralization sump or pit?	Proper maintenance should be done periodically. Limestone may be eliminated by controlling the pH of materials before they are discharged. Assume sump contents are hazardous if unknown because they are a collection point for sediments, solvents, and mercury.	
Are deposits from low points in plumbing properly disposed of?	Sediments and mercury will tend to collect in low points making the waste hazardous. Assume sediments are hazardous if unknown.	
Do you store chemicals near drains and sinks?	Chemicals stored near drains and sinks should have double containment. Install lipped sinks if necessary. Avoid storing chemicals above sinks.	
Do you have floor drains in your laboratory or in chemical storage/receiving areas?	Protect or plug floor drains to prevent spills from entering the sewer system. Temporary drains can be installed at safety showers.	
Do you use aspirators or water seal vacuum pumps?	Aspirators and single pass water seal pumps use a lot of water and may entrain and discharge chemicals to the sewer. Alternatives include recirculating water seal pumps and mechanical pumps.	
Do you dispose of your vacuum pump oil properly?	Vacuum pump oil may be contaminated with cross contact of chemicals or radioactivity. Characterize and dispose of it according to hazardous waste regulations.	
Have you reviewed the ingredients in your cleaners?	Phenolic compounds may be present in disinfectant cleaners. Phenols are toxic and some are bioaccumulative. Use phenols only when required. The alternative to phenols are quarternary amine substitutes.	p. 4.41
Do you minimize use of cleaning products?	Premeasured dose dispensers can be used to ensure products like phenols are used only to the extent needed.	

Are your chemicals securely stored?	Equip chemical storage shelves with secondary containment. Never use a sink as secondary containment. Keep secondary containment dry at all times.	
Does your distillation unit have secondary containment?	Your distillation unit should have secondary containment to prevent any spills from entering floor drains and to protect workers.	
Do you keep hazardous wastes from entering the laundry?	Keep articles like thermometers and spill cleanup rags out of the laundry to prevent discharge to sewer.	
Have you considered installing water conservation devices?	Flow restrictors on sinks and rinse tanks will save water. Reduce rinse times whenever possible. Also, water recyclers on distillation units can save tens of thousands of gallons of water per year.	See Appendix G.4 - Case Study #3 Lab Saves 39,000 Gallons per year of Water

<input type="checkbox"/> Electron Microscopy		Reference Manual
Do you develop photographs?	A Code of Practice for Photoprocessing that describes best management practices and equipment is available for free from the P2 Program by calling 873-7004.	
Do you properly dispose of photographic fixer?	Used photographic fixer contains high concentrations of silver that should not be poured down the drain. Fixer should be desilvered before pouring down the drain or can be sent to an off-site recycler.	See Appendix C.12 and C.13 for a list of desilvering product vendors and recyclers that process photographic fixer.

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